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The Extension Pathologist

"TO PROMOTE ECONOMIC CROP PRODUCTION,
IMPROVE THE QUALITY OF THE PRODUCTS, AND
REDUCE WASTAGE IN STORAGE, TRANSIT, AND AT THE MARKET"



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THE EXTENSION PATHOLOGIST

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NOTE: Owing to press of field work during the period from May 27 to August 27, it was necessary to suspend publication of The Extension Pathologist for three months. This is the first number issued since May, 1925. F.C.M.

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MARKET PATHOLOGY AND ITS RELATION TO THE
EXTENSION PROGRAM

How do market requirements affect the plant-disease program? As a rule, the farmer's interest in plant-disease control starts because of the necessity for crop conservation. He sees his fruit trees or his potato plants in danger of destruction and takes steps to prevent the disaster. It often happens, however, that the prospect of field losses from disease is not sufficient to move him to action. Indeed, the beginning of control work on some farms dates from the time when a buyer refuses to take the grower's produce because of blemishes resulting from disease.

Of recent years this market demand for fruits and vegetables of good quality has influenced farmers in some parts of the country in their disease control program. This is partly due to activities of State and Federal workers in connection with the establishment of grades and standards and the maintenance of a point of origin inspection service.

Grades give the trade an opportunity to express the desire of the consumer in a common language. They bring to the farmer information which enables him to sort his produce with a view to meeting the requirements of the market. Point of origin inspection shows him wherein he has succeeded or failed to produce the type of fruit desired at the market.

As we look over the grades, which have been recorded by the Department of Agriculture for some 30 crops, it is evident that as he attempts to pack his produce to comply with these the farmer will be forced to improve his control methods. Freedom or partial freedom from disease is maintained in the case of every crop involved. As these grades are coming into use and point of origin inspection is developing the extension pathologists fill a new demand for work.

The following paper by Dr. Dean H. Rose should be of interest to all extension pathologists working in territories from which fruits and vegetables are distributed. Such a summary of research activities in this field should help in a general study of extension opportunities growing out of market contacts. F.C.M.

MARKET PATHOLOGY IN THE UNITED STATES

By Dr. Dean H. Rose, Pathologist,
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Market pathology, as a definitely named and organized branch of the work of the U. S. Department of Agriculture, has been in existence only since the establishment of the Food Products Inspection Service in November, 1917. The diseases of fruits and vegetables during the marketing process and means

by which they could be controlled had been studied for many years previously, however, by the U. S. Department of Agriculture, by experiment stations, and by various individuals interested in the marketing of perishables.

Naturally enough, attention was directed first toward means of control or rather toward one promising means; namely, refrigeration. The earliest recorded use of refrigeration for fruit in transit in the United States occurred in 1866 (53, 12), when Mr. Parker Earle of Cobden, Ill., shipped strawberries in refrigerator chests by express as far as Chicago, New York, and New Orleans. In 1868, Mr. D. W. Davis of Detroit, Mich., perfected and patented a refrigerator car on which he had been working since 1865. Using this car he and Mr. Earle made successful shipments of strawberries from Cobden, Ill., to Buffalo, N. Y., and of peaches from Dayton, Ohio, to New York City. Really successful and dependable refrigerator service was not developed, however, until 1887, when Mr. F. A. Thomas of Chicago, put into operation a private car line for the transportation of fruit from important producing sections to the larger markets.

As already pointed out by Shear and Stevens (50) and by Link and Gardner (20), the first investigations were made by men who professionally at least were not pathologists. Probably the earliest investigation which dealt definitely with the problem of market pathology is that carried out during the years 1904 to 1908 by G. Harold Powell (37, 38), then pomologist in the Bureau of Plant Industry. For several years prior to that period the shippers of California citrus fruit had suffered such heavy losses from the decay of their fruit in transit that they finally came to feel that the future of the citrus industry was threatened and asked for help. Powell's work on the problem, his demonstration that blue mold is the chief cause of the decay, that it enters only through skin breaks, and that control lies in the most rigorously careful handling methods - all of these constitute one of the triumphs of American botanical science.

The handling and packing methods thus proved by Powell to be indispensable to the profitable marketing of citrus fruit were at once put into practice on a large scale and have made possible the development of an industry which, in 1923, did a business amounting to nearly \$44,000,000.¹

This, incidentally, is only one of several instances in which control methods peculiarly applicable to marketing conditions have been taken up readily by growers, shippers, or carriers, and made a part of their regular routine. Others which may be mentioned are (1) the use of oiled wrappers to prevent scald on boxed apples, (2) the use of ventilated half-barrel boxes instead of tight barrels for the shipment of cranberries and (3) the stem treatment of watermelons to prevent stem-end rot. Less definitely aimed at any specific disease, but none the less valuable in preventing transit decay

¹U. S. Department of Agriculture Yearbook 1923, PP. 740-742.

are (1) the early picking of strawberries and (2) the installation of the slatted false floor and solid bulkhead in refrigerator cars. The first three of these have become almost the universal practice in the producing sections and for the crop to which they are applicable. The two latter are coming into use more slowly. The use made of all five shows clearly, however, that provided a reasonable amount of attention is given to extension work, growers and other handlers of perishables are quite ready to adopt control programs which include much more than the conventional spraying with Bordeaux mixture or sulphur fungicides.

Somewhat later than the time of Powell's work in California, pathologists began the study of market diseases of fruits. In 1910, Scott (47) of the Bureau of Plant Industry called attention to the importance of brown rot in the marketing of peaches and gave figures showing the losses which often result from this disease in transit and on the market. He also reported the results of shipping tests which showed that peaches sprayed with self-boiled lime sulphur arrived in better condition on the market and brought a better price than unsprayed peaches from the same orchard. (See also Shear, 48.) Stevens and Wilcox (52, 53) studied the relation of rots to the marketing of strawberries. Hawkins (18) worked out the potato handling methods in relation to leak, Meier (30) investigated stem-end rot as a factor in the marketing of watermelons, and Rosenbaum (46) studied the Florida tomato situation with reference to field and transit conditions. Mention should also be made of the work of F. L. Stevens (51) on diseases of fruits and vegetables in transit and the study made by Coons and Nelson (11) on the condition in which fruits and vegetables arrive in the Illinois Central yards in Chicago.

Since the establishment in 1917 of definite projects in market pathology in the Bureau of Plant Industry, an extensive survey has been made of the occurrence of diseases on fruits and vegetables in transit and in storage. Work has also been begun on certain special diseases, the object being to discover how they are affected by handling methods, by weather at the time of harvest, and by temperature conditions. The results of the first year's study of the market pathology of truck crops have been summarized by Link and Gardner (20).

In that article they called attention to the diseases which affect a great variety of vegetable crops; namely (1) slimy soft rot, under which are grouped all the bacterial soft rots, (2) watery soft rot, caused by Sclerotinia libertiana, (3) rhizopus rot caused by rhizopus species, (4) gray-mold rot caused by botrytis species, probably B. cinerea in most cases. In addition, they listed by crops the principal diseases found and gave for each a more or less definite estimate of the losses which result from it. Subsequent work by this project on market diseases of vegetables has enlarged the number of diseases found, has emphasized the importance of handling and refrigeration methods, and has resulted in the publication of a number of circulars (20, 21, 22, 23, 24, 25, 30, 31) and technical papers on botrytis rot of the globe artichoke (26) and black rot of carrots (33).

Work on the market pathology of fruits has yielded results similar to those mentioned above for the work on vegetables. The diseases which occur on a wide variety of fruits have been found to be (1) blue-mold rot caused by various species of *Penicillium* (2) rhizopus rot and (3) gray-mold rot. Publications include a technical paper on a serious rot of strawberries (45), phytophthora rot of apples and pears (in press), a circular on spraying experiments to control strawberry rots (54), a statistical bulletin on diseases of apples on the market as shown by certificates issued by the Foods Products Inspection Service during the four-year period ending June 30, 1921 (43), and a farmers' bulletin on diseases of stone fruits on the market (44).

Aside from the work done in the two projects already mentioned (market pathology of fruits and market pathology of vegetables), mention should also be made of investigations by other workers in the U. S. Department of Agriculture and various experiment stations. The more important of these as described in the literature include studies on diseases of apples in storage by Plagge Maney (36), by Whitehouse (57), by Magness and Diehl (29), and by Brooks; Cooley and Fisher (5, 7, 10); on the storage and marketing of pears by Magness (27, 28) and by Overholser and Latimer (34); on internal browning of apples by Ballard, Magness and Hawkins (1) and by Overholser, Winkler and Jacob; on deterioration of citrus fruit due to various causes, in transit and on the market, by Fawcett (13) and by Bartholomew, Barrett and Fawcett (3); on citrus stem-end rot by Winston, Fulton and Bowman (58); on factors affecting the shipment of various fruits and vegetables by Ramsey, Stubenrauch and others (39, 40, 41, 42); on brown rot of peaches by Brooks and Fisher (8, 9, 14); on storage rots of sweetpotatoes by Harter and his associates (15, 16, 17); and on blackheart of potatoes by Bartholomew, Barret and Fawcett (3) and by Bennett and Bartholomew (4).

From this brief summary it is evident that a good beginning has been made in the study of market diseases of fruits and vegetables. As always in science, however, much more remains to be done. We still know all too little (1) about the rôle played by bacteria in transit and storage decay, (2) about the relation of moisture, temperature, and ventilation to decay and other deterioration in transit and storage and (3) about the effect of weather conditions in the field on that congeries of characters known as carrying quality.

Losses continue to be heavy in the marketing of many of the important crops. Research must therefore go on, stimulated always, and continually put into practice by thorough-going extension work.

Literature Cited

- (1) Ballard, W. S., J. R. Magness, Lon A. Hawkins.
Internal browning of the Yellow Newton apple. U.S.D.A. Bul. 1104.
24 p. 1922.

- (2) Bartholomew, E. T.
A pathological and physiological study of the blackheart
of potato tubers. Centralbl.F.Bakt., II, 43:609-639. 3pl. 1915.
- (3) Bartholomew, E. T., J. T. Barrett and H. S. Fawcett.
Internal decline of lemons. Amer. Jour. Bot. 10:67-70, 117-126. 1923.
- (4) Bennett, J. P., and E. T. Bartholomew.
Respiration of potato tubers in relation to the occurrence of black-
heart. Univ. of Calif. Publ. Techn. Paper 14. 35 p., illus., 1924.
- (5) Brooks, Charles, and J. S. Cooley.
Temperature relations of apple-rot fungi. Jour. Agr. Research 8:
139-163. 1917.
- (6) _____
Temperature relations of stone fruit fungi. Jour. Agr. Research 22:
451-465. 1921.
- (7) Brooks, Charles, and D. F. Fisher.
Irrigation experiments on apple-spot diseases. Jour. Agr. Research
12:109-137. 1918.
- (8) _____
Transportation rots of stone fruits as influenced by orchard spraying.
Jour. Agr. Research, 22: 467-477. 1921.
- (9) _____
Prune and cherry brown-rot investigations in the Pacific Northwest.
U. S. Dept. Agr. Bul. 1252. 21 p. 1924.
- (10) Brooks, Charles, J. S. Cooley and D. F. Fisher.
Diseases of apples in storage. Farmers' Bul. 1160. 23 p. 1922.
- (11) Coons, G. H. and Ray Nelson.
The plant diseases of importance in the transportation of fruits and
vegetables. Amer. Railway Perishable Freight Assoc. Circ. 473-A.
59 p. illus. 1918.
- (12) Earle, F. S.
Development of the trucking interests. U. S. Dept. Agr. Yearbook
1900:437-452.
- (13) Fawcett, H. S.
Decay of citrus fruits on arrival and in storage at eastern markets.
Calif. Citrograph 10:1, 12, 22. 1924. 79, 98, 99, 103. 1925.

- (14) Fisher, D. F. and Charles Brooks.
Control of brown-rot of prunes and cherries in the Pacific Northwest.
Farmers' Bulletin 1410. 12 p. 1924.
- (15) Harter, L. L. and J. M. R. Adams.
Sweetpotato storage rots. Jour. Agr. Research 15: 337-368. Pl. 21-27.
1918. Literature cited, p. 366-368.
- (16) _____ and J. L. Lauritzen.
The decay of sweetpotatoes (Ipomoea batatas) produced by different
species of Rhizopus. Phytopathology 11:279-284. 1921. Literature
cited p. 284.
- (17) _____ and J. L. Weimer.
Decay of various vegetables and fruits by different species of
Rhizopus. Phytopathology 12:205-212. 1922.
- (18) Hawkins, Ion A.
Experiments in the control of potato leak. U. S. Dept. Agr. Bul.
577. 5 p. 1917.
- (19) Lauritzen, J. I., and L. L. Harter.
Species of Rhizopus responsible for the decay of sweetpotatoes in
the storage house and at different temperatures in infection
chambers. Jour. Agr. Research 24:441-456. 1923.
- (20) Link, G. K. K. and Max W. Gardner.
Market pathology and market diseases of vegetables. Phytopathology
9:497-519. 1919.
- (21) Link, G. K. K. and F. C. Meier.
Anthracnose of muskmelons. U. S. Dept. Agr. Dept. Circ. 217. 1922.
- (22) _____
Fusarium tuber rot of potatoes, U. S. Dept. Agr. Dept. Circ. 214.
1922.
- (23) _____
Late-blight tuber rot of the potato. U. S. Dept. Agr. Dept. Circ.
220. 1922.
- (24) _____
Phoma rot of tomatoes. U. S. Dept. Agr. Dept. Circ. 219. 1922.
- (25) Link, G. K. K. and W. A. Orton.
Powdery dry-rot of potato. Cotton, Truck and Forage Crop Disease
Circ. 1, 1918.

- (26) Link, G. K. K. and G. B. Ramsey, and Alice A. Bailey. Botrytis rot of the globe artichoke. Jour. Agr. Research 29:85-92. 1924.
- (27) Magness, J. R. Investigations in the ripening and storage of Bartlett pears. Jour. Agr. Research. 19: 473-500. 1920.
- (28)

The handling, shipping, and cold storage of Bartlett pears in the Pacific Coast States. U. S. Dept. Agr. Bul. 1072. 16 p. 1922.
- (29) Magness, J. R. and H. C. Diehl. Physiological studies on apples in storage. Jour. Agr. Research 27:1-38. 1924.
- (30) Meier, F. C. Watermelon stem-end rot. (Preliminary Paper.) Jour. Agr. Research 6:147-152, pl. 17. 1916.
- (31) Meier, F. C. and G. K. K. Link. Bacterial spot of cucumbers. U. S. Dept. Agr. Dept. Circ. 234. 1922.
- (32)

Potato brown-rot. U. S. Dept. Agr. Dept. Circ. 281. 1923.
- (33) Meier, F. C., Charles Drechsler and E. D. Eddy. Black rot of carrots caused by *Alternaria radicina* n.sp. Phytopathology 12: 157-166. 1922.
- (34) Overholser, E. L. and L. P. Latimer. The cold storage of pears. Calif. Agr. Exp. Sta. Bul. 377. 56 p. 1924.
- (35) Overholser, E. L., A. J. Winkler and H. E. Jacob. Factors influencing the development of internal browning of the Yellow Newtown apple. Calif. Exp. Sta. Bul. 370. 40 p. 1923.
- (36) Plagge, H. H. and T. J. Maney. Apple storage investigations. Iowa Agr. Exp. Sta. Bul. 222, 64 p. 1924.
- (37) Powell, G. Harold. The handling of fruit for transportation. U. S. Dept. Agr. Yearbook. 1905: 349-362. pl. 34-37. 1906.
- (38) Powell, G. Harold, A. V. Stubenrauch, L. S. Tenny and others. The decay of oranges while in transit from California. U. S. Dept. Agr. Bur. Pl. Ind. Bul. 123, 79 p. 1908.

- (39) Ramsey, H. J.
Factors governing the successful shipment of red raspberries from the Puyallup Valley. U. S. Dept. Agr. Bul. 274. 35 p. 1915.
- (40) _____
The handling and shipping of fresh cherries and prunes from the Willamette Valley. U. S. Dept. Agr. Bul. 331, 13 p. 1916.
- (41) _____
Handling and shipping citrus fruits in the Gulf States. Farmers' Bulletin 696, 27 p. 1915.
- (42) Ramsey, H. J. and E. L. Markell.
The handling and precooling of Florida lettuce and celery. U. S. Dept. Agr. Bul. 601. 27 p. 1917.
- (43) Rose, Dean H.
Diseases of apples on the market. U. S. Dept. Agr. Bul. 1253. 24 p. 1924.
- (44) _____
Diseases of stone fruits on the market. Farmers' Bulletin 1435. 17 p. 1924.
- (45) _____
Leather rot of strawberries. Jour. Agr. Research 28:357-375. 1924.
- (46) Rosenbaum, J.
The origin and spread of tomato fruit rots in transit. Phytopathology, 8:572-580, 1 fig., pl. 4, 1918.
- (47) Scott, W. M., and T. W. Ayres.
The control of peach brown rot and scab. U. S. Dept. Agr. Bur. Pl. Inds. Bul. 174, 31 p. 1910.
- (48) Shear, C. L.
Pathological aspects of the fruit and vegetable inspection service. Phytopathology 8: 155-160. 1918.
- (49) _____
Pathological problems in the distribution of perishable plant products. Brooklyn Botanic Garden Memoirs. 1:415-422. 1918.
- (50) Shear, C. L. and N. E. Stevens.
Plant pathology to-day. Scientific Monthly. 7:235-243. 1918.

- (51) Stevens, F. I.
Some problems of plant pathology in reference to transportation.
Phytopathology, 5:108-110. 1915.
- (52) Stevens, N. E. and R. B. Wilcox.
Rhizopus rot of strawberries in transit. U. S. Dept. Agr. Bul.
531. 22 p. 1917.
- (53) _____
Further studies of the rots of strawberry fruits. U. S. Dept. Agr.
Bul. 636, 13 p. 1918.
- (54) Stoddard, E. M., D. H. Rose and N. E. Stevens,
Spraying strawberries for the control of fruit rots. U. S. Dept.
Agr. Circ. 309. 1924.
- (55) Stubenrauch, A. V., H. J. Ramsey, L. S. Tenny and others.
Factors governing the successful shipment of oranges from Florida.
U. S. Dept. Agr. Bul. 63. 50 p. 1914.
- (56) Taylor, William A.
The influence of refrigeration on the fruit industry. U. S. Dept.
Agr. Yearbook 1900:561-580.
- (57) Whitehouse, W. E.
Cold storage for Iowa apples. Iowa Agr. Exp. Sta. Bul. 192: 179-216.
- (58) Winston, J. R., H. R. Fulton, and J. J. Bowman.
Commercial control of citrus stem-end rot. U. S. Dept. Agr. Bul.
293. 10 p. 1923.

ANNOUNCEMENTS

Extension Service Handbook

In the March-April number of the Extension Pathologist mention was made of a handbook which is being prepared by the U. S. Department of Agriculture for use by county agents and other agricultural workers. This book is now in the hands of the editor, and it is expected that it will be ready for distribution sometime this winter.

Extension Conference in Kansas City

Dr. R. J. Haskell, Secretary of the American Phytopathological Society, in discussing plans for the midwinter program at Kansas City, informs us that Tuesday afternoon, December 29, has been reserved for round table conference on extension work. At this time opportunity will be given members of the society to discuss ways of teaching farmers to adopt control practices.

The first conference of this nature was held in connection with the Boston meeting in 1922. Since then the extension conference has been a popular feature of the midwinter meetings.

LITERATURE

When making out your mailing list for literature dealing with the subject of plant-disease control, please do not forget this office. We are glad to cite all literature of this sort which is sent in.

Illinois:

Guba, Emil Frederick, Phyllosticta leaf spot, fruit blotch, and canker of the apple: Its etiology and control. Ill. Agr. Exp. Sta. Bul. 256; 76 p. illus. Feb. 1925.

Stevens, Frank Lincoln and O. A. Plunkett. Tulip blossom blight. Ill. Agr. Exp. Sta. Bul. 265; 8 p. illus. April, 1925.

Kansas:

Stokdyk, E. A. Selection of sweetpotatoes. Journal of Heredity, Vol. XVI, No. 4. April, 1925.

Maine:

Folsom, Donald, and Reiner Bonde. *Alternaria solani* as a cause of tuber rot in potatoes. *Phytopathology*, May, 1925, Vol. XV. No. 5.

Maryland:

Ezekiel, Walter N. Fruit-rotting *Sclerotinias*. II. The American brown-rot fungi. *Uni. of Md. Agr. Exp. Sta. Bul.* 271; 55 p. illus. Oct. 1924.

Johnston, Earl S. Growth of potato plants in sand cultures treated with the "six types" of nutrient solutions. *Uni. of Md. Agr. Exp. Sta. Bul.* 270; 32 p. illus. Sept. 1924.

Hamilton, Clyde C. The biology and control of the chrysanthemum midge. *Uni. of Md. Agr. Exp. Sta. Bul.* 269; 37 p. illus. Aug. 1924.

Hamilton, Clyde C. The boxwood leaf miner. *Uni. of Md. Agr. Exp. Sta. Bul.* 272; 26 p. illus. Feb. 1925.

Symons, T. B. Tenth annual report, University of Maryland Extension Service for the year 1924; 204 p. illus.

Nebraska:

Goss, R. W. Potato wilt and tuber rots. II. "Run-out" potatoes caused by degeneration diseases. *Uni. of Nebr. Agr. Col. Ext. Circ.* 1256; 23 p. illus. April, 1925.

Pennsylvania:

Trimble, F. M. Scale insects injurious in Pennsylvania. *Pa. Dept. Agr. Bul.* 398; 22 p. illus. Feb. 1925.

McCubbin, W. A. Apple rust and its control. *Pa. Dept. Agr. Bul.* 411; 10 p. illus. Sept. 1925.

Guyton, T. L. and A. B. Champlain. The oriental fruit moth. *Pa. Dept. Agr. Bul.* 405; 7 p. illus. June, 1925.

Leach, B. R. Control of Japanese beetle in lawns. *Pa. Dept. Agr. Bul.* 410; 11 p. illus. Aug. 1925.

Washington:

Heald, F. D., G. L. Zundel and L. W. Boyle. The dusting of wheat and oats for smut. *Phytopathology*, Vol. XIII. No. 4, April, 1923.

Wisconsin:

Linford, M. B. and R. E. Vaughan. Root-rot of peas - Some ways to avoid it. Wis. St. Agr. Col. Ext. Circ. 188; 11 p. April, 1925.

News notes, extension articles, or suggestions with regard to subjects that might be discussed profitably in this news sheet should be addressed to:

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